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Annex 4 - Geothermal Power in Indonesia

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CONTEXT

Indonesia has the world's largest geothermal power development potential, estimated at approximately 27 GW (World Bank 2008). However, progress in realizing this potential has been slow, with only 1,200 MW of installed capacity to date (Crosetti 2012). Fossil fuels currently account for over 80 percent of electricity generated in Indonesia (World Bank 2011) and provide the cheapest means to meet its rapidly growing electricity demand, given market distortions. Although some progress was made in attracting investment in geothermal power in the 1990s, development stalled during the Asian financial crisis in 1997-98 and has been slow to pick up. In the early 2000s, a number of barriers deterred investment in the sector, including[1]:

- A policy framework that favored conventional energy sources, including subsidies[2] for oil- and coal-based electricity.
- Lack of a regulatory framework for pricing renewable energy, requiring developers to negotiate a power purchase agreement (PPA) on a case-by-case basis with the state-owned utility Perusahaan Listrik Negara (PLN), which had no obligation to buy renewable electricity and no incentive to do so given its higher price.
- Lack of government management and planning capacity for geothermal energy at the national and local government levels (World Bank 2008).
- Insufficient domestic technical capacity among industry for geothermal development (World Bank 2008).
- Lack of access to finance for geothermal projects due to the high risk perceived by financial institutions.
- High costs and risks associated with exploration of geothermal resources, which had to be borne by the developer (World Bank 2008).

EFFORTS TO CREATE AN ENABLING ENVIRONMENT

An inventory of geothermal resources conducted in 1972 inspired a number of policy reforms that enabled the state-owned oil company, Pertamina, to explore and develop geothermal energy, and incentivized private sector companies to partner with Pertamina to build and operate geothermal power plants (Fauzi et al. 2000). By the late 1990s five geothermal fields with a combined capacity of 527 MW were operating and 12 contracts were in place, with a total commitment of over 3,000 MW. However, progress stalled during the Asian financial crisis in 1997-98, and several contracts with private companies were suspended and some later canceled (Fauzi et al. 2000).

After the crisis, geothermal development was slow to pick up. The government undertook a number of initiatives to revive and promote the sector, including a geothermal law in 2003 and a roadmap for geothermal development that established a target of 6,000 MW of installed geothermal capacity by 2020. The new law allowed the private sector to participate in geothermal development through contracts awarded through a competitive tender process; previously, private sector participation was limited to joint operating contracts with Pertamina. However, the government was slow to establish implementing regulations, and despite ambitious targets, the law failed to address many barriers to investment, including the unfavorable pricing structure and exploration risk of geothermal energy.

The geothermal law also devolved authority to regional governments to license geothermal working areas (Wahjosoedibjo and Hasan 2012). However, limited capacity in regional governments hindered the successful tendering of contracts for geothermal working areas. In addition, information on resource potential was insufficient for bidders to accurately estimate cost, and successful bidders had to negotiate a PPA with PLN after award of the contract. This created a risk both to PLN, who had to agree an initial price without knowing the characteristics of the geothermal resource, and to the developer, who had no guarantee that they would get a price sufficient

BOX 1 | HIGHLIGHTS

- Geothermal development in Indonesia stalled during the 1997-98 Asian financial crisis and was slow to pick up due to a number of major barriers, including a policy framework that was not conducive to investment and the high cost and risk of exploration and producing geothermal energy, compared to coal.
- In 2003, a Geothermal Law was passed to open new opportunities for private sector investment and a target of 6,000 MW of installed geothermal capacity was set. However, implementation of the law was delayed.
- Following several revisions to the pricing regulations, in 2012 the government introduced a variable feed-in-tariff for geothermal electricity that sets prices for different regions based on cost of production, ranging from 10¢ to 17¢ per kWh.
- A Geothermal Fund was established in 2011 with $145 million from the 2011 budget to fund initial exploration of geothermal working areas, thereby reducing the risk to developers.
- Despite slow progress, recent efforts by the government of Indonesia and its international partners have contributed to creating a more favorable environment for investment by tackling policy and regulatory barriers and introducing a mechanism to better balance the risk of exploration.

to recoup their investment costs (Wahjosoedibjo and Hasan 2012). Faced with rapidly rising electricity demand and an abundance of cheap coal, the government viewed expanding conventional energy generation as a more pressing priority than promoting geothermal power development, and in 2006 introduced a program to fast-track 10,000 MW of power generation capacity through coal power. A second fast-track program in 2008 aimed to add another 10,000 MW, this time with 60 percent from renewable sources, including 4,800 MW of geothermal power (CIF 2010).

Since 2010, the Indonesian government has shown a greater interest in and made progress toward geothermal development. At the World Geothermal Conference in 2010, which Indonesia hosted, the government made high-level commitments to geothermal development. In 2011 the government reorganized the Ministry of Energy and Mineral Resources (MEMR), creating a new Directorate General for New and Renewable Energy that includes a directorate for geothermal energy, which was previously housed within the Directorate General for Coal, Minerals, and Geothermal.

Regulations were issued in 2009 that set a maximum tariff of 9.7¢ per kWh of geothermal electricity. They were then revised in 2011 to require PLN to buy geothermal power upon successful negotiation of a PPA. The regulations left open the option for the winners of geothermal tenders to negotiate a higher tariff with PLN, but the utility was not obliged to purchase such power (Wahjosoedibjo and Hasan 2012, Girianna 2011, Crosetti in litt. 2012). Although these were an improvement on previous pricing regulations, they did not account for the different costs of developing geothermal resources at different sites (Wahjosoedibjo and Hasan 2012). In July 2012 a favorable revision to the pricing regulations introduced a variable feed-in-tariff for geothermal electricity that sets prices for different regions based on cost of production, ranging from 10¢ to 17¢ per kWh (Pramudatama 2012).

Under the 2003 geothermal law, the high risk of geothermal exploration is borne by the developer. To overcome this barrier to investment, the government set up a geothermal fund in 2011 under the Ministry of Finance, with $145 million from the 2011 national budget to fund initial exploration before tendering geothermal working areas (Wahjosoedibjo and Hasan 2012). The fund will be made available to geothermal projects using the Public Private Partnership scheme, and the costs of the survey and the initial exploration will be recovered through data compensation to bidders and drilling cost reimbursement to the winning bidder. Enhancing the data on resource availability should make the geothermal risk more defined and manageable when the working area is offered for tender, resulting in more accurate pricing (Wahjosoedibjo and Hasan 2012).

Investment in geothermal development has been limited thus far, and much of the existing ~1,200 MW capacity was installed through the pre-crisis regime,[3] with only ~260 MW of new capacity added over the past decade under the new legal framework (Crosetti 2012). The first large-scale independent power producer exploration under the 2003 law was only initiated in 2012 (Siahaan 2012). Despite this, the government has made gradual progress in creating a more attractive investment climate and there is growing interest in geothermal energy in Indonesia. There remain a number of barriers, including complex and bureaucratic permitting requirements and limited capacity of local governments for tendering geothermal sites.

A further challenge is that a large proportion of Indonesia's geothermal potential lies in its remaining forest areas. Therefore, all geothermal development needs to consider the environmental and social risks, and is subject to regulations governing geothermal mining and permitting in forests (Ashat and Ardiansyah 2012). Transparency and adequate stakeholder consultation will be important in understanding and mitigating these risks. While the government is not on track to reach its targets, by some estimates ~ 600 MW will be added by 2014 and ~ 1,400 MW by 2016 (Crosetti 2012).

THE ROLE OF INTERNATIONAL SUPPORT

International support has been an important driver of geothermal development in Indonesia. In 1972 a number of international partners—including the United States, Italy, Japan, and New Zealand—provided technical assistance for an inventory of geothermal resources. This led to the pre-crisis policy reforms, which stimulated geothermal power development until the Asian financial crisis (Fauzi et al. 2000). After the crisis, there was little or no international support for geothermal development until the mid-2000s. Between 2006 and 2012, several international partners have supported projects and programs that aim to address some of the barriers to geothermal development mentioned above.

Since 2008, the World Bank has been implementing a program with $4 million in funding from the Global Environment Facility (GEF) that aims to support implementation of the geothermal law by assisting the government to develop rules and regulations and a policy framework to provide economic incentives for investment, strengthen institutional capacity within MEMR for planning and engaging investors in geothermal transactions, and facilitate closure

of a number of ongoing and pending transactions (World Bank 2008). Although it is entirely focused on readiness activities, it has been slow to make progress in creating an enabling environment for investment in geothermal and has taken longer to implement than anticipated (World Bank 2010).

Several other international partners—including Japan's International Cooperation Agency (JICA), the Asian Development Bank (ADB), the German development bank KfW, the Netherlands, and New Zealand—have provided readiness support for further resource assessments, feasibility studies, environmental and social impact assessments, and institutional strengthening, in some cases in addition to providing project finance for geothermal power plants. KfW is also providing readiness support for exploration at two sites, as well as technical assistance and training for provincial governments responsible for the tendering of working areas under the 2003 law, and has committed to providing project finance if the exploration proves successful. KfW's readiness support is roughly three percent to five percent of its committed investment in geothermal development in Indonesia.[4]

KfW, ADB, and JICA have also provided technical support to the government in the design of the geothermal fund.[5] ADB has expressed interest in supporting the fund with financing roughly equal to the government's own commitment, and has proposed a design for the fund. However, ADB has made the funding conditional on requirements that the government is unwilling to agree to, and to date, there has been no international financing for the fund.[6] In 2010 the Clean Technology Fund (CTF) approved an investment plan (CIF 2010) for Indonesia to provide $300 million in concessional financing through the ADB, World Bank, and International Finance Corporation (IFC) to support public and private sector geothermal development. In 2011 the CTF approved a $125 million concessional loan for the construction of a $575 million geothermal plant through the World Bank, which is contributing a further $175 million (CTF 2011). The World Bank's readiness support for geothermal development is roughly two percent of the financing committed to this project.[7]

OBSERVATIONS AND INSIGHTS

Although the government of Indonesia has been working to develop geothermal power in Indonesia for more than 40 years, progress has been slow. Only in the last few years has the government made significant progress in creating a more favorable climate for investment. Insights include:

- Pricing distortions have been a major barrier to geothermal energy in Indonesia. Although the real life-cycle costs of generating geothermal energy are competitive with conventional energy sources if global environmental externalities are considered (Castlerock Consulting 2010), subsidized prices for fossil fuel electricity and the lack of a clear pricing structure for geothermal energy have been a disincentive for investment.

- Support for geothermal exploration is an important readiness activity that needs public funding. There is little incentive for private developers to undertake exploration given the high risk and cost and lack of financing available. The geothermal fund has been designed with the intention of mitigating this risk.

- Readiness support needs to be sustained over long periods of time and may not yield results in the first few years. A World Bank program initiated in 2008 that focuses on a number of enabling activities has been slow to progress, but is still under way and gradually showing results as improved pricing regulations are implemented and capacities strengthened.

- Strong government leadership is important. Although a geothermal law was passed in 2003, pricing regulations to implement the law were only passed several years later and then underwent a series of revisions, with the most recent regulations passed in 2012. This did not give investors confidence in the government's commitment to creating an attractive investment climate for geothermal energy. A renewed commitment to geothermal development in recent years has led to some promising reforms, including an improved pricing structure, new institutional arrangements, and the establishment of a risk mitigation mechanism. As a result, Indonesia seems positioned for a gradual scaling up of geothermal development over the coming years.

Table 1 | **Milestones in the Development of Indonesia's Geothermal Energy Sector**

YEAR	MILESTONE
1972	Inventory of geothermal resources was conducted with support from Italy, Japan, New Zealand, and the United States.
1974	Presidential decree appointing state-owned oil company Pertamina to explore and develop geothermal energy in conjunction with domestic and international partners (Fauzi et al. 2000).
1981	Presidential decree allowing Pertamina to enter joint ventures with local and international partners.
1983	First large-scale geothermal development by state-owned utility PLN, installing 140 MW in geothermal power plants (Fauzi et al. 2000).
1991	Presidential decrees provided economic incentives for joint ventures between Pertamina and private companies to build and operate geothermal power plants.
1997	Start of the Asian financial crisis.
1998	Presidential decree suspended private contracts for geothermal (Fauzi et al. 2000).
2003	The government promulgated the Geothermal Law to open up new opportunities for private and public investments in the geothermal sector, and established a target of 6,000 MW of installed geothermal power capacity by 2020.
2004	Japan International Cooperation Agency (JICA) signed a loan of approximately $48 million (5,866 million yen) to develop a 20 MW geothermal power plant in North Sulawesi (JICA 2004).
2007	JICA conducted a technical assessment of geothermal resources, which contributed to the government's geothermal development planning (World Bank 2008).
2008	The government launched the "second fast track program" to develop 10,000 MW of power, of which 60 percent would be renewable energy, including 4,800 MW of geothermal.
2008	A program aimed at removing barriers to geothermal development was initiated with World Bank support and a grant of $4 million from GEF. Activities included policy development, technical capacity building, and support for transacting geothermal projects (World Bank 2008).
2009	The government issued regulations to enact the 2003 Geothermal Law, which set a maximum tariff of 9.7¢ per kWh (Castlerock Consulting, 2010; Wahjosoedibjo and Hasan 2012).
2010	The government of The Netherlands provided a grant of about $2.5 million through the World Bank to Pertamina to support the preparation of a number of geothermal fields (CIF 2010).
2010	The Clean Technology Fund (CTF) approved an investment plan for Indonesia, which included $300 million in concessional finance to support the transformation of Indonesia's geothermal sector.
2011	KfW support for development of a geothermal field in Aceh with a €7.7 million grant for exploration of the working area (KfW 2011).
2011	The geothermal clean energy investment project was approved under the CTF investment plan for steam field development and construction of a geothermal plant. This $574.7 million project will be funded with $175 million through an IBRD loan, a $125 million concessional loan from the CTF, and $274.7 million from Pertamina.
2011	The government issued new regulations under the 2003 Geothermal Law, which set a maximum tariff of 9.7¢ per kWh on geothermal electricity, and required PLN to buy geothermal power upon successful negotiation of a power purchase agreement (PPA). It also provided for prices above 9.7c per kWh upon negotiation with PLN. (Crosetti 2012, Girianna 2011).
2011	The government—with technical support from KfW, ADB, and JICA—set up a geothermal fund with $145 million to fund initial exploration of geothermal working areas before putting them out to tender.
2012	MEMR introduced a variable feed-in-tariff for geothermal electricity that sets prices for different regions based on cost of production, ranging from 10¢ to 17¢ per kWh

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ENDNOTES

1. Personal interviews with in-country experts.
2. For more on Indonesia's fossil fuel subsidies, see Beaton and Lontoh (2010).
3. Geothermal fields that were awarded under the pre-crisis regulatory regime are not subject to the new regulations; instead, development continued under joint operating contracts between Pertamina and the private sector following the previous regulations, and negotiating a PPA on a case-by-case basis with PLN.
4. Author calculations.
5. Personal interviews with in-country experts.
6. Personal interviews with in-country experts.
7. Author calculations.

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